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Ahead: making synthetic protein do work for us

New optics, excitation for x-ray spectrometer

No more guesses in vacuum leak detection

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Japan's Open Door: Is the U.S. Missing Its Golden Opportunity?

Japan has opened its new superconductivity lab to outsiders, but U.S. companies are ignoring the invitation.

*By **Robert Cassidy**, Senior Editor, Business, R&D magazine*

JUST A MONTH AGO, Prof. Shoji Tanaka of Tokyo Univ., the physicist who, over the past 13 years, has led Japan to supremacy in semiconductors, fiber optics, and optical disks, opened the doors of a state-of-the-art research laboratory at Tokyo's International Superconductivity Technology Center (ISTEC).

After the opening ceremonies, dozens of researchers from 45 Japanese companies began studying and developing high-temperature superconductive (HTS) materials.

The creation of the ISTEC lab is viewed by some observers as defining a new role for Japan, not only in science and technology, but in foreign relations as well. They see in Japan's superconductivity initiative a chance for that nation to become a world-class leader in basic research, much as it has dominated consumer electronics in the past two decades.

Japan watchers also view the HTS program as concrete evidence of the country's policy of *kokusaika*, or internationalization. Japan is determined to change its image abroad from that of a nation respected for its ability to exploit the research of others, to that of an intellectual superpower capable of opening new frontiers of scientific investigation and magnanimously sharing the fruits of that research with others.

"Japan is in the process of redefining its role in the world," says Martha Harris, head of the National Research Council's Japan Office. "In years past, there has been criticism of Japan as a country that absorbed technology and flourished in the marketplace, but which did not pass its knowledge back to the rest of the world. *Kokusaika* is an attempt to define a new role, putting more resources into science and technology and opening up those resources to others."

For the U.S., the opening of the ISTEC lab is notable for yet another reason: No American scientists are working there, despite an invitation to foreign companies to peer through the *madoguchi*, or window, onto Japan's HTS research. Three U.S. companies—DuPont, IBM, and Rockwell Intl.—have joined ISTEC as junior partners but are not doing research in the new lab.

Corporate America's decision to reject Japan's invitation to participate in joint research raises an important policy question: Why, after years of complaining that the Japanese have been "stealing" their research, are U.S. companies unwilling to join hands with them on what could be one of

With no payoff in sight, American industry has done well to resist the temptation to pour money down a rathole.

the most profitable new technologies in postwar history—especially when knowledgeable sources such as the Federal Office of Technology Assessment (OTA) are saying that U.S. companies already may have fallen behind the Japanese in HTS research?

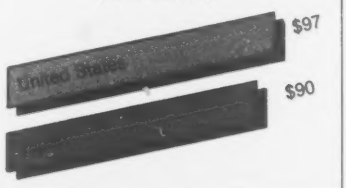
From interviews with researchers, business executives, and Japanologists, a clear but disturbing explanation begins to emerge as to why American firms are snubbing Japan's offer to cooperate on HTS research. The reasons range from Yankee caution to outright xenophobia, with a touch of hubris thrown in for good measure.

Practical matters

One barrier to U.S. involvement in ISTEC is the cost—for full members, about $800,000 to pay for the lab construction, another $90,000 a year in dues. The three U.S. firms involved have signed up at a lower level, about $16,000 to join and an equal amount in annual dues. That's supposed to provide them with a newsletter and admittance to a few meetings, but not access to the lab. This compares to the 90 Japanese firms that have joined ISTEC, half of them at the full price.

DuPont sees junior membership as a must. "If you're an international organization like DuPont, you have to do it," says spokesman Alan Lauder. The company has 220 employes, almost all Japanese, at its Yokohama

Corporate support of HTS research, 1988
(in millions)



Why go to Tokyo, asks Schmitt, when you can go to Houston?

technical facility. "We're not faced with the problem of having to learn the culture, but there are not a great number of U.S. corporations that have a presence like that in Japan," he says.

"We joined at the low price, which gives us access [to the newsletter and meetings], but where we don't have to play scientist," says Lauder. "We certainly didn't think it was worth the full price. We'll make a decision about that later on."

Rockwell Intl.'s chief scientist says his company is optimistic, but cautious, about joining ISTEC. "The majority of our business addresses global markets, and our R&D must be international as well," says Peter Cannon. "It would be a Greek tragedy, with *hubris* writ large, if we thought we could do it all by ourselves." Rockwell has a number of joint ventures in Japan, including one with Mitsubishi.

IBM, which has a separate division in Japan, would say only that junior membership "best suits our business needs."

But many more have balked at the hefty tab. "This past spring, I asked Dr. Tanaka himself what you get for joining, and I don't think it was clear even to him," says Bellcore's assistant vice president John M. Rowell. "At that price, it's a pretty expensive newsletter." Besides, he says, "the research will be in the pre-emptive stage, so it will probably be published in the open literature."

Rowell notes that full members also must absorb the cost of sending one or two scientists—who are fluent in Japanese, no less—to work at the ISTEC lab. "I would have picked a site other than Tokyo," he says. "The cost of living there is impossible, so you have to commute two hours to get to work."

Former General Electric research chief, now president of Rensselaer Polytechnic Inst. (Troy, NY), Roland Schmitt feels that the Japanese failed

Who's ahead in the race for superconductivity?

IT'S NOT SUPPOSED to be asked, but whenever researchers talk about superconductivity, the question gets raised anyway: Who's ahead, the U.S. or Japan?

To some, it's a moot point, since commercial application is so distant. Rockwell Intl. chief scientist Peter Cannon says it likely will take the equivalent of 1,000 world-class scientists working "several years" before any breakthrough occurs.

Setting aside the argument that, as a spokesman for IBM phrased it, "nationalism is not the issue," how are the two nations deploying their forces? And what does that say about who's likely to come out on top in the race for HTS supremacy?

According to the Congressional Office of Technology Assessment, the Japanese government will spend about $70 million this year on superconductivity research, working through four ministries: the Ministry of International Trade & Industry (MITI), whose projects include the ISTEC program; the Science & Technology Agency (STA), whose New Superconductivity Materials Research Assn. is, like ISTEC, open to foreigners (although no U.S. companies have joined); the Ministry of Education (Monbusho), which supports university research much as the U.S.'s NSF does; and the Ministry of Transportation, which is helping to finance a magnetically levitated train project.

In private industry, at least 38 firms were spending about $90 million and had 900 scientists, engineers, and technicians at work on both low- and high-temperature superconductivity as of the early part of this year, the OTA says.

The U.S. government will devote $95 million to HTS alone in 1988, the bulk of it for the Depts. of Defense ($46.0 million) and Energy ($27.2 million). NSF will get $14.5 million, NASA $4.2 million, NIST (formerly NBS) $2.8 million, and the Bureau of Mines $100,000.

OTA says that 55 U.S.-based companies have about 625 researchers working on both LTS and HTS. They will spend $97 million in corporate funds this year.

Roughly speaking, the resources

to sell U.S. companies on ISTEC's benefits. "They have to do a lot more marketing, and perhaps start a little more modestly [in cost]," says Schmitt.

Another reason why American companies have not joined Japan's HTS initiative, he says, is that they have plenty of opportunities for research partnerships in the U.S. Why go to Tokyo, Schmitt asks rhetorically, when you can go to Houston?

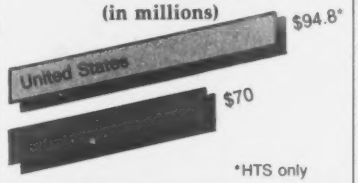
"Besides, U.S. firms have a lot of experience working with American universities, and they know what to expect," says Schmitt. "We don't have that kind of experience working with Japanese institutions, so there's more risk."

Schmitt also would like to see the Japanese change some of their rules. "People talk about reciprocity between the U.S. and Japan, but reciprocity doesn't mean symmetry," he says. "For an American firm to get something out of ISTEC requires a much greater level of commitment than it does working with a U.S. program. It took the Japanese years and years to learn how to extract science from us, and now that they may have something for us to draw out, it's ridiculous for them to expect Americans to learn how to do that overnight."

Finally, there are those who say caution is advisable because commercialization is so far down the road. "There's no payoff in sight," says Prof. Rustum Roy of Pennsylvania State Univ. "Unless this particular technology brings some enormous economic advantage, it's not going to cut it with business.

"The Europeans are taking a wait-and-see position, and American industry has done well to resist the impulse to pour money down a rat hole." Roy says he favors sending researchers to foreign countries when the possibility of commercialization looks more promising.

Government support of superconductivity research, 1988
(in millions)



The Japanese are widely mistrusted, says an R&D executive.

"The managers of U.S. companies have been astute enough to see that an HTS product is not just around the corner, so why get involved with Japan?" adds Harry Kroger, a former Sperry researcher now with the Microelectronics & Computer Technology Corp. (MCC) in Austin, TX. MCC has a $1.3-million HTS effort under way, involving more than a dozen U.S. companies. "ISTEC is a monster-sized effort, but I don't know if it will succeed," he says. "It's based on a lot of faith."

Some knowledgeable observers say they are disturbed that more U.S. companies are not taking a gamble with ISTEC. "If you're really committed to doing work at the state of the art, then you want to know what others are doing," says Richard Samuels, director of MIT's Japan Science and Technology Program. "That's what the Japanese mean by *madoguchi*. It's a window of opportunity."

A hidden agenda?

Yet another reason U.S. firms are passing up Japan's invitation to share HTS research may be that it looks too good to be true. "The Japanese are widely mistrusted," says a chemical-industry executive. "They give nothing and get what they can out of you. There's lots of skepticism as to their sincerity about sharing technology."

An oil-company researcher who has worked in Japan says, "I don't believe

being devoted by each country appear comparable. A few individuals feel that the U.S. has the edge. A survey of 51 U.S. electronics firms by *Electronic Business* magazine revealed that the majority of computer executives believe the U.S. is clearly ahead.

In "Commercializing High-Temperature Superconductivity," its recent report on the subject, OTA states—in bold type—that "American companies may already have begun to fall behind."

OTA says that, while a few major U.S. corporations—it mentions IBM, AT&T, and DuPont—are mounting "substantial efforts," too many others have taken a wait-and-see attitude. "They plan to take advantage of developments as they emerge from the laboratory—someone else's laboratory—or buy into emerging markets when the time is right," says the report.

Such strategies have not worked in recent years, the OTA says. Japanese companies, in contrast, see HTS as "a major new opportunity," and are willing to take greater risks to exploit that opportunity than are their American counterparts.

"The Japanese have the cash to exploit any discoveries, no matter where they are made," says the DOE's Ianniello. "With a few exceptions like IBM, most U.S. companies are not in the position of looking beyond a few years."

"We're spending more money, but you don't see any clarity of objectives," says OTA's John Alic. The bulk of the Federal dollars are going to national laboratories and universities, which Alic says "don't have a good track record of successful technology transfer."

But Bellcore's John M. Rowell says he doesn't agree with those who say the U.S. already has lost the race. "Dr. Tanaka told me that *they* feel they have to keep up with *us*," says Rowell.

So who's winning? Right now, it's probably anybody's game. Victoria Nerenberg, of the Superconductor Applications Assn., says "the true competition will be lab to lab, company to company, regardless of national boundaries."

But no matter what, says DuPont's Alan Lauder, "The benefits are going to come to those who are in it for the long haul, and with deep pockets." Whether they will be Japanese or American remains to be seen. □

If you decide not to join Japan's HTS effort, make sure it's not because of scientific arrogance, says MIT's Samuels.

it's a new dawn. My experience is that they say they want to work with us, but what actually happens is quite different. I don't think Japan is going to turn over a new leaf in its dealings with the rest of the world, certainly not as HTS gets closer to commercialization."

"There's a lot of showmanship to this," says Louis Ianniello, of the U.S. Dept. of Energy. "They're tough competitors, and I wonder how much they're going to just give away."

Victoria Nerenberg, director of the California-based Superconductor Applications Assn., says the Japanese "want to create an open-door policy so that they can't be accused of stealing our technology."

"I don't believe there are any hidden motives," says MCC's Kroger. "I have not found them to be devious. When I visit a Japanese lab, they're extremely open—more open than Americans are to their competitors. They're tight when it comes to things close to product, but so are we."

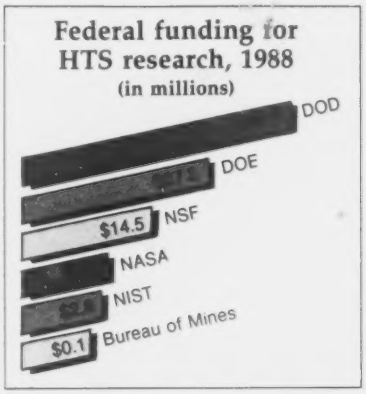
"We've had good relations with the Japanese," says Bellcore's Rowell. "I suspect that many of my people would rather work in Japan than in America, because there's more competition between U.S. companies. Try getting information out of AT&T."

"They're damned if they do and damned if they don't," says MIT's Samuels. "They're accused of either getting a free ride or of having a hidden agenda."

Some blame the ignorance—or myopia—of American business executives. "Most American companies have no idea of how to do business in Japan," says a chemist with experience working in Japan. "They view the Japanese as cut-throat, but that perception is driven by fear or repugnance toward the Japanese culture, not reality."

Americans would do better to learn from the Japanese, he says. "The Japanese are better at information gathering than we are, but I don't fault them for that," he says. "I do it when I'm visiting another lab, and I don't see it as unethical. If you're careless, the Japanese will exploit you to the fullest. You have to know what you're doing when you deal with them."

By not joining ISTEC, U.S. firms may be missing out not only on the lastest information about how to exploit superconductivity, but also on what their Japanese competitors and the government ministries are doing. The Japanese themselves see this "watchdog approach" as one of the main reasons to participate. As NEC vice president Michiyuki Uenohara told the *Wall Street Journal*, "Those by-products are more important to us than the technology itself."



U.S. business may pay a price for ignoring this opportunity.

Yet everyone in the superconductivity game realizes that at some point the door could get slammed shut. "The closer we get to commercial application, the more reluctant people will be to talk about what they're doing," says DuPont's Lauder.

Overcoming pride

Despite the $60-billion trade imbalance Japan holds over the U.S., too many American firms prefer to go it alone, avoiding opportunities like Japan's HTS initiative. "There's still that 'if it's worth doing, we'll do it ourselves' attitude," says an American research director.

There are those who see the HTS invitation as a device for the Japanese, who view themselves as weaker than their American counterparts in basic research, to seduce the U.S. into "giving away" its research. "They have a rigid, bureaucratic research sector, especially in the universities," says the OTA's John Alic. RPI's Schmitt notes that "they have a few stars like Tanaka, but they don't have the depth of our university system."

"They realize that most of the fundamental breakthroughs have come from the West, and they need the synergism of having some of the main U.S. firms involved," an R&D executive says. "They have a need, and they're responding to it. They're not acting out of altruism."

But others say that American businesses may pay the price for ignoring openings like the ISTEC program with even greater declines in their global competitiveness. "U.S. companies think they're only competing against themselves when they're really competing against the whole world," says Bellcore's Rowell.

"If I were an adviser to American businesses, I would tell them not to lose an opportunity to have access to Japan's efforts," says MIT's Samuels. "Those may be bargain-basement prices. And if you come to a decision not to join the Japanese effort, make sure it's not because of scientific arrogance. The firms that are interacting with the Japanese, in Japan, are going to benefit in the long run."

Will Japan's HTS initiative succeed in producing the breakthroughs, both scientific and political, it is designed to achieve?

"I think we should expect to wait some time before the full implications of what's happening are felt," says NRC's Harris. "It will take a number of years for attitudes to change.

"For Japan, superconductivity has become a test for these new challenges, challenges that are broader than the science and technology issues themselves," adds Harris. The experimentation that is under way, both in the lab and in world politics, will be "of great interest to those who are watching Japan because it could be indicative of what's going on in the whole culture."

It should, she says, "be exciting to watch." **R&D**

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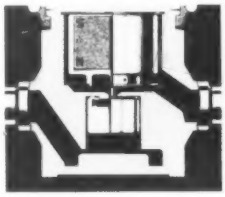

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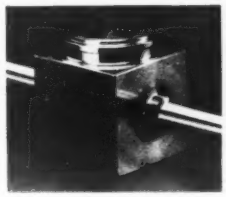

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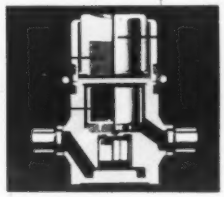

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